

# REPORT DOCUMENTATION PAGE

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(no msh issued)

MEMORANDUM FOR PRS (In-House/Contractor Publication)

FROM: PROI (STINFO)

18 June 2002

SUBJECT: Authorization for Release of Technical Information, Control Number: AFRL-PR-ED-AB-2002-149

D.B. VanGilder (ERC) et al., "A Comparison of Sputtering Models for Plasma-Surface Interactions"

(abstract only)

\* 55412 (unofficial notification)

28<sup>th</sup> Int'l Electric Propulsion Conference

(Statement A)

(Toulouse, France, March 2003) (Deadline = 14 June 2002 = PAST DUE)

Fife  
56792

## A Comparison of Sputtering Models for Plasma-Surface Interactions

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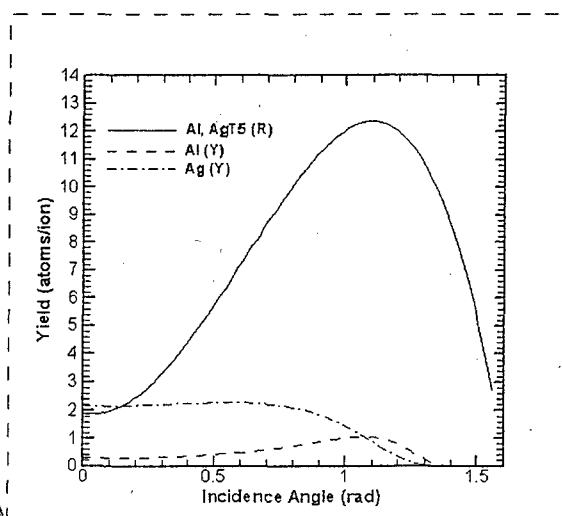
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The interaction of electric propulsion plumes with spacecraft surfaces is studied in order to predict possible spacecraft contamination. For example, ions in the plume may cause surface sputtering and this sputtered material may be deposited on other surfaces.

Several models exist for the sputtering of surface material by ion bombardment based on various experimental data. These models depend on the ion species and materials from the data. In order to assess the uncertainty in sputtering predictions, this paper will present a comparison of models for sputtering of spacecraft materials due to operation of Hall-effect thrusters using xenon as a propellant. How this sputtering affects the redeposition will also be examined. The sputter yield versus angle for 300eV ions hitting aluminum and silver is shown in the figure below for two models. The one labeled "R" is from Roussel et al., "Numerical Simulation of Induced Environment, Sputtering and Contamination of Satellite due to Electric Propulsion," Proc. Second European Spacecraft Propulsion Conf. 1997. The other (labeled "Y") is from Yamamura et al., "Angular Dependence of Sputtering Yields on Monatomic Solids", Institute of Plasma Physics, Nagoya University, June 1983. A 3-D plasma interaction modeling system named COLISEUM has been developed and will be used as a tool to test these models as well as others (for example, Kannenberg et al., "Validation of Hall Thruster Plume Sputter Model", 37<sup>th</sup> JPC, July 2001).



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Figure: Comparison of sputter yields for Al and Ag by Xe+ ions at 300eV.